1. A causal LTI system is implemented with the difference equation

$$y(n) = x(n) + 0.9\, y(n-5).$$

   (a) Find and sketch the impulse response of the system.

   (b) Find the dc gain of the system.

   (c) Find the steady-state value of the step-response of the system.

2. An LTI system has impulse response

$$h(n) = 2\left(\frac{1}{3}\right)^n \cos\left(\frac{\pi}{3}\, n\right) u(n).$$

   (a) Derive a difference equation to implement the system. Show your work.

   (b) Find the poles and zeros of the system. Sketch the pole/zero diagram.

3. A causal LTI system is implemented by the difference equation

$$y(n) = x(n) + y(n-1) - y(n-2).$$

   (a) Find the impulse response $h(n)$. Express $h(n)$ without j.

   (b) Find the poles and zeros of the system. Sketch the pole/zero diagram.

   (c) Classify the system as stable/unstable.

4. An LTI system has impulse response

$$h(n) = 3\,(0.8)^n\ u(n).$$

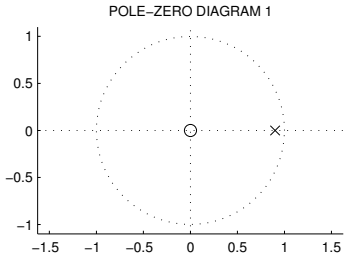
   Find the output signal $y(n)$ produced by input signal

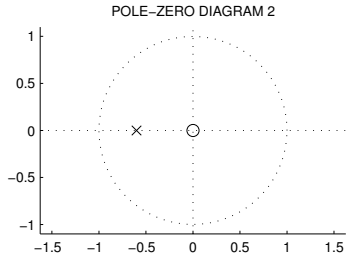
$$x(n) = 2\,(0.9)^n \cos\left(\frac{\pi}{4}\, n\right) u(n).$$

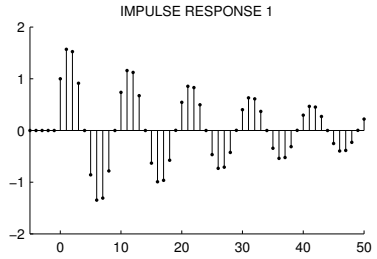
   You need not find $y(n)$ exactly. Express $y(n)$ as accurately as possible without computing the residues in the partial fraction expansion. Your answer should not contain j.

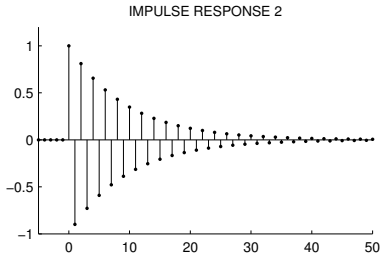
5. The impulse responses and pole-zero diagrams of eight LTI systems are shown on the next page — but they are out of order. Match the systems by completing the table.

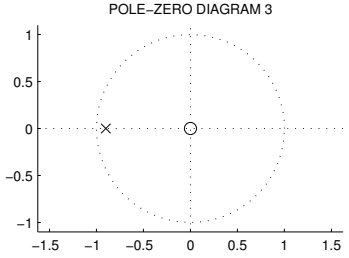
Pole-zero diagram	Impulse response
1	
2	
3	
4	
5	
6	
7	
8	

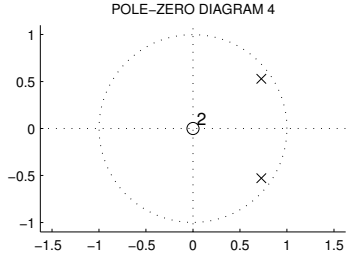

POLE−ZERO DIAGRAM 1

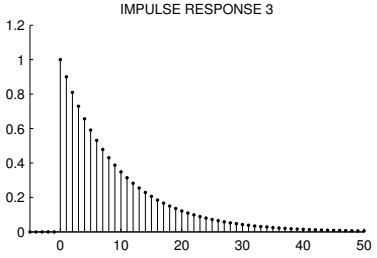

POLE−ZERO DIAGRAM 2

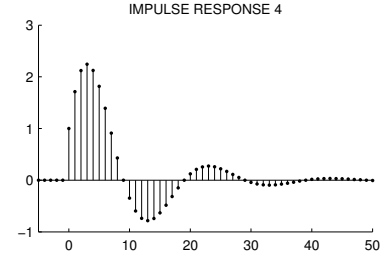

IMPULSE RESPONSE 1

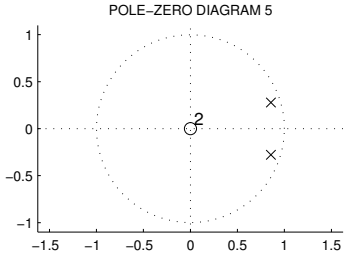

IMPULSE RESPONSE 2

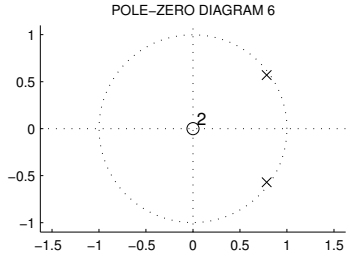

POLE−ZERO DIAGRAM 3

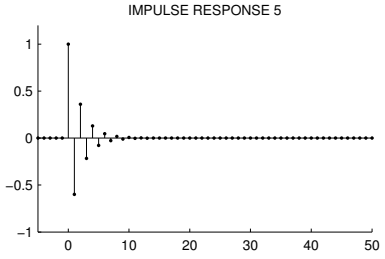

POLE−ZERO DIAGRAM 4
2

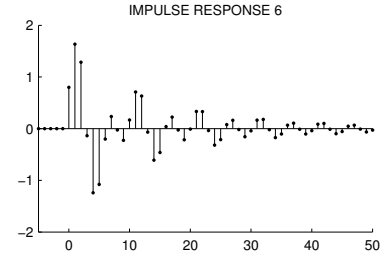

IMPULSE RESPONSE 3

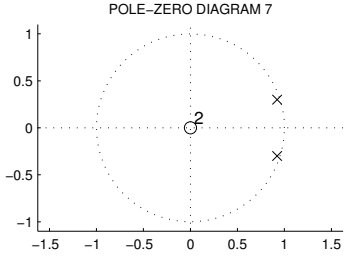

IMPULSE RESPONSE 4

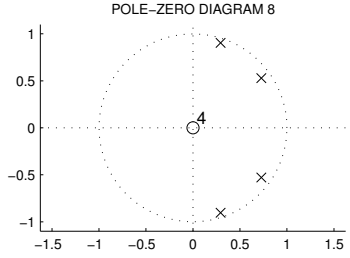

POLE−ZERO DIAGRAM 5
2

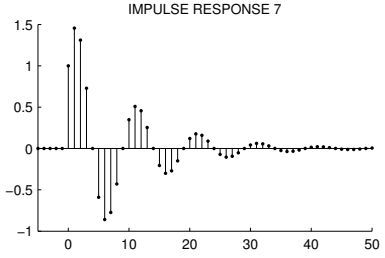

POLE−ZERO DIAGRAM 6
2

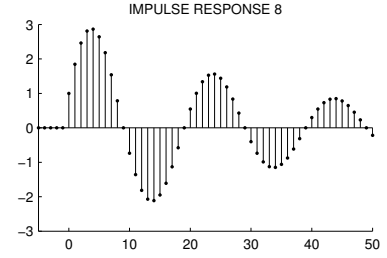

IMPULSE RESPONSE 5


IMPULSE RESPONSE 6


POLE−ZERO DIAGRAM 7
2


POLE−ZERO DIAGRAM 8
4


IMPULSE RESPONSE 7


IMPULSE RESPONSE 8